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ABSTRACT

A description is provided of the format used to estimate the costs associated with the development and operation of a computer-managed instructional system. Total costs are conceptualized as a function of the number of hours devoted to each stage of the project and the cost per hour. The data management systems which were developed required expenditures for personnel and computer time; instructional system development necessitated expenditures in these two categories and also for copyright fees and supplies. Operational costs involved outlays for personnel, computer time, and instructional materials. Also discussed are the uses of cost information and the recent specifications by the federal government of the cost accounting procedures which must be used in federally funded projects at institutions of higher education which receive more than $100,000 in federal funds per year. (PB)

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COST CONSIDERATIONS IN COMPUTER MANAGED INSTRUCTION [1]

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Introduction

> *A major component of the reform we seek obviously must be increased productivity -- finding ways of getting more out of each dollar invested by turning away from obsolescent cottage industry methods through a major reordering of our principal resources, including teaching talent, and wider reliance on technology, which is our principal hope for the effective development and implementation of high-quality, lower unit cost learning. (National Association of Educational Broadcasters, 1972, p. 4)*

Although the goals expressed in the quotation from Commissioner of Education Marland's Annual Report to Congress are probably acceptable to most educators, the methodology necessary to achieve these goals is, unfortunately, yet to be developed. For example, the ability to develop lower unit cost instruction requires the ability to both determine the unit cost of current instruction and to predict with some degree of accuracy the unit cost of the proposed instruction. While those educators engaged in instructional development have focused on the specification of instructional objectives, the design of evaluation instruments, the determination of aptitude-treatment interactions, and the production of instructional materials; the determination of procedures for ascertaining the cost of instructional development has been, by comparison, largely ignored. Hopefully by reporting the costs which were incurred in the development of five computer managed instructional modules, this paper will make one small step toward providing the professional educational community with the information required to move toward lower unit cost instruction. The costs which were incurred are described and reported on the following pages.

Developmental Costs

The estimated direct costs of developing the data management system and the five computer-managed instructional modules are reported in Table 1. Indirect costs, such as fringe benefits and institutional overhead, have not been included. Not all of the costs reported in Table 1 were incurred by the funding agency, some being absorbed by the institution and the individuals involved. These figures do not include the cost of revision following the formative evaluation.

Since personnel time constituted the major expense of instructional development (approximately 83%), a special procedure was employed in an attempt to insure the accurate recording of the expenditure of time. Each individual was given a form and asked to maintain a weekly record of the amount of time spent on the project. Several of the project personnel failed to maintain accurate records and the time expended by these individuals was estimated. Whenever possible, the accurately recorded time expenditures for the performance of similar tasks was used as a basis for these estimates.

Operational Costs

The operational costs associated with the use of four modules (excluding Statistics) for the 330 students in the ten conventional classes are reported in Table 2. Since procedures had been established for recording the costs of supplies and computer time prior to the implementation of this project, no special procedures were required to insure the accurate recording of these operational costs. Thus, the information in Table 2 was obtained through a simple analysis of the records normally maintained by the Computer-Assisted Instruction Laboratory.

Table 1

ESTIMATED DEVELOPMENT COSTS FOR THE DATA MANAGEMENT SYSTEM AND THE FIVE INSTRUCTIONAL MODULES

	Estimated Time in Hours	Total Hours	Estimated Cost
Data Management Systems Development			
Personnel			
Management	35		
Systems Analyst	121	156	$ 805.00*
Computer (IBM 1500 System)			
Author time @ $12.18/hr	25.9		
Utility time @ $48.73/hr	2.0	27.9	412.00
			$ 1,217.00
Instructional System Development			
Personnel			
Management	415		
Authors & Instructional Designers	1,246		
Systems Analyst	311		
Computer Programmers	415		
Keypunch Operators	35		
Secretarial/Clerical	380		
Instructors	87	2,889	$ 9,602.00*
Computer			
CDC 6600 System @ $260/hr	0.2		
IBM 1500 System:			
Author time @ $12.18/hr	44.3		
Utility time @ $48.73/hr	19.2	63.7	$ 1,527.00
Copyright Fees			210.00
Supplies and Materials			100.00
			$ 11,439.00

* Estimated salaries excluding fringe benefits

Table 2

CMI OPERATIONAL COSTS

(First 300 students using four modules)

	Time in Hours	Total Hours	Cost
Personnel			
Management	35		
Secretarial/Clerical	69		
Proctors	363		
Operators	190	657	$ 1,740.00*
Computer (IBM 1500 System)			
Student time @ $6.09/hr	822.0		
Utility time @ $48.73/hr	16.5	838.5	5,810.00
Instructional Materials			377.00
			$ 7,927.00

Uses of Cost Information

The cost information reported in Tables 1 and 2 falls into two categories. The first consists of the amounts of resources such as time and materials which were consumed. The second consists of the dollar costs which were assigned to these resources. Since both costs of resources and procedures used to assign costs to resources vary with the organizational environment, the knowledge of the amount and types of resources which were consumed is far more valuable than the knowledge of the dollar amounts assigned to the resources.

The information presented in Tables 1 and 2 is of value primarily to those who are considering producing similar computer-managed instruction and wish to predict the amount of resources required and/or the costs to be incurred. Such a prediction requires little more than an estimation of the current cost of the resources to be consumed and the multiplication of this estimate by the amount of resources consumed in this project. Uses of the information which has been collected and reported beyond the prediction of the cost of a similar project are severely limited. For example, not enough information is available to make any statements concerning the behavior of operational costs attributable to the gain or loss of economy of scale resulting from an increase or decrease in the number of students receiving the instruction each semester.

Any comparisons of the costs incurred in this project with those incurred in a similar project would first require one set of cost data to be adjusted to remove the variance attributable solely to the differences in educational environments such as salaries and the variance attributable solely to general economic conditions such as inflation. Since the salaries received by specific individuals are not reported, an accurate adjustment is quite impossible.

Costing Models

The limitations on the uses of the cost data which have been reported are attributable to the lack of highly detailed reporting of both the cost information and the procedures used to collect and assign costs. The original intent was to delve rather deeply into both these areas. However, the events of recent months strongly indicate that another course would be more appropriate.

During the last year the literature has become increasingly cluttered with descriptions of costing procedures or models (See Doughty and Beilby, 1974). These models attack the fundamental problem in costing, assigning or allocating indirect costs to outputs, in a variety of ways. While this is certainly permissible in an environment which is not burdened with the constraints imposed by agencies such as the Internal Revenue Service or the Securities and Exchange Commission, it is not an appropriate way to generate information which is comparable across organizational environments. Quite simply, the same information processed by different procedures or models produces different, often extremely different, results. An author who adds yet another model to the literature could readily be accused of littering - a serious crime in this age of ecological awareness.

Although most costing studies to be performed in educational environments will be allowed to employ any procedures deemed appropriate, recent actions by the Cost Accounting Standards Board (1973) and U.S. Government General Services Administration (1973) strongly suggest that studies of the cost of CMI will be constrained. In essence, the federal government has specified a set of cost accounting procedures which must be used in federally funded projects at institutions of higher education which receive more than $100,000 in federal funds per year. In other words, the U.S. Government has specified its own model and

is saying "If you use our money, use our costing model." For the many CMI projects being conducted at institutions of higher education which receive more than $100,000 in federal funds, the choice of costing models has already been made. Although the author can only speculate, the trends seem to indicate that all institutions receiving over $100,000 in federal funds will soon be required to use this model. Therefore, a close examination and a gradual move toward the implementation of the government's costing model seems warranted. If the same model or procedures are used in all CMI projects, then the resulting cost information may be easily compared. And, if the individuals employing the model are aware of how the model functions, the sources of the variances in costs of projects at different institutions may be readily determined and analyzed.

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